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BC hydro

BRITISH COLUMBIA

2000 Dinosaur Reservoir Creel Survey Report

J. Joslin
June 2001

PWFWCP Report No. 257

105-02384/

The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

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This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

Citation: J. Joslin. June 2001. 2000 Dinosaur Reservoir Creel Survey Report. Peace/Williston Fish and Wildlife Compensation Program, Report No. 257. 22pp plus appendices.

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2000 Dinosaur Reservoir

Creel Survey Report

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ACKNOWLEDGMENTS

The author wishes to thank Brian Blackman (PWFWCP, Prince George), Nick Baccante (MOELP, Fort St. John), and Bob Westcott (BC Hydro). Without their contribution this report would not be possible.

EXECUTIVE SUMMARY

An evaluation of the Dinosaur Reservoir stocking program was conducted during the summer of 2000. Anglers were surveyed for a period of 18 weeks from May 6 to September 10. The survey used a double stratified random creel sampling method based on Dixon (1986).

An estimated total of 1761 (+/- 181) anglers utilized Dinosaur Reservoir during the summer creel survey period. These anglers expended an estimated 4339 hours to catch 1236 (+/- 279) fish. Of these, 1086 were rainbow trout (88%). This represented an overall catch rate of 0.25 fish per hour. The success rate varied considerably by month and whether the party was using boat (0.31 fish per hour) or shore (0.16 fish per hour). The average angler day was 2.25 hours (+/- 0.20). Seventy percent (70%) of fish caught were released. Local fishermen accounted for most anglers (85%) utilizing Dinosaur Reservoir during the 2000 season.

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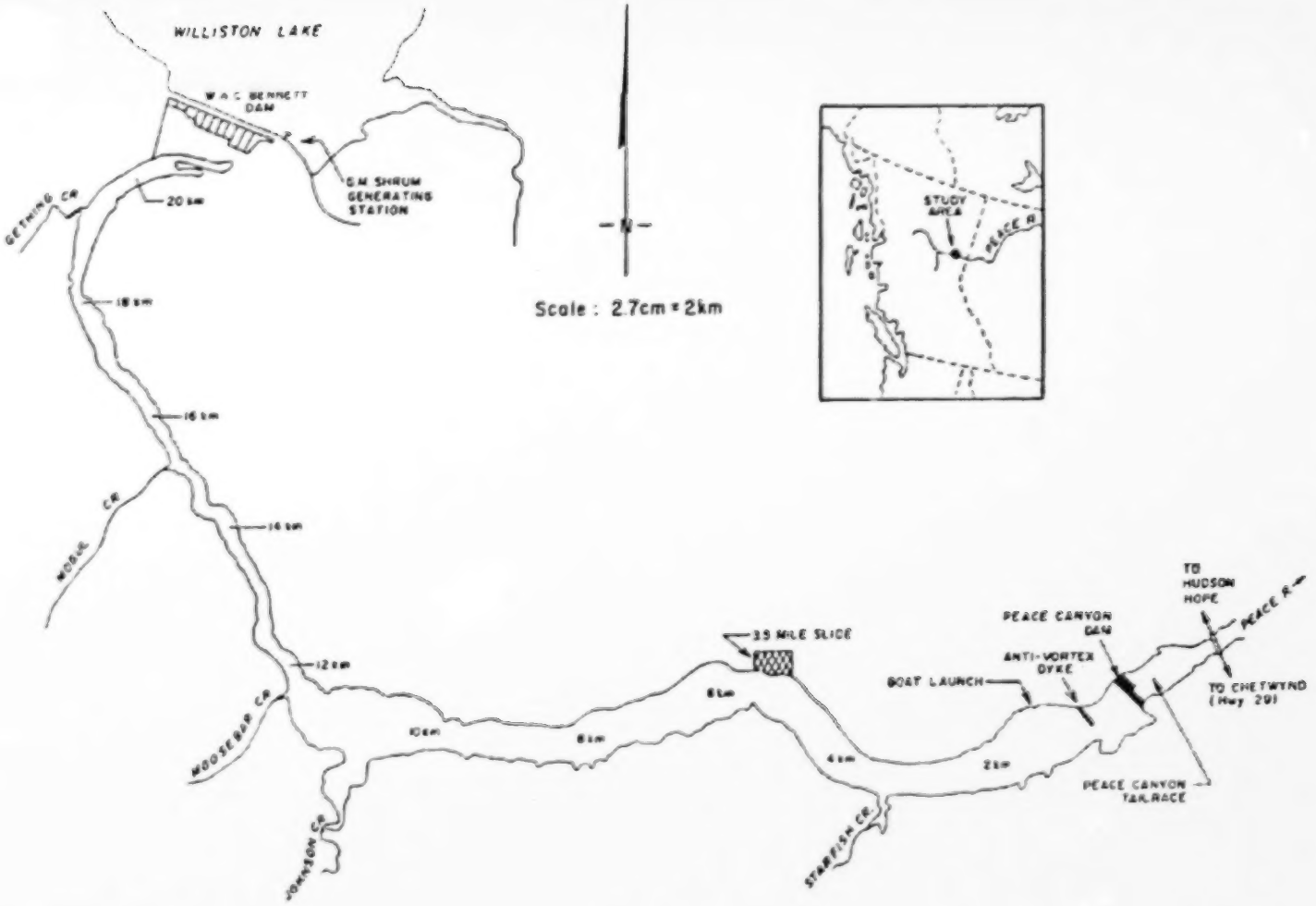

Figure 1. Map and Location of Dinosaur Lake.

INTRODUCTION

Background

Dinosaur Reservoir was formed in 1980 with the completion of the Peace Canyon Dam. In order to provide improved recreational angling opportunities this reservoir has been stocked with rainbow trout *(Oncorhynchus mykiss)*. The stocking was carried out by the Peace Canyon Hatchery (funded by B.C. Hydro) until 1988 when the facility was closed. Since that time the reservoir has been stocked with fish provided by the Ministry of Environment Lands and Parks. The angler surveys conducted from 1984 to 1988 suggested that many of the trout released into the reservoir moved downstream through the dam and into the Peace River, but that the remaining "hatchery" fish comprised about 50% of the total catch from Dinosaur Reservoir. Angler success was rated as low but the reservoir received relatively high angling pressure (Hammond, 1988; Pattenden and Ash, 1993b).

The creel survey evaluation program had been inactive until 1999 and 2000. Two summers of creel surveys have been carried out, with the goal of assessing any major changes in the fishery and to determine the effectiveness of the current of annual stocking regime.

Objectives

An evaluation of the fishery in Dinosaur Reservoir is required to determine the effectiveness of the stocking program. The information gathered may also be used in the development of management strategies for Dinosaur Reservoir and provides baseline data for the evaluation of possible future enhancement projects. The survey and evaluation also hopes to determine the state of the sport fishery relative to the costs of stocking and enhancement.

METHODS

A creel survey was conducted at the single road access point to Dinosaur Reservoir. The purpose was to determine angler effort, success rates and other user information. The survey followed the methodologies of a "Double Stratified Random Sample Creel Survey" (Dixon 1986).

2000 was the longest survey period to date, with most of the previous surveys lasting about 9 weeks from early July to early September. A minimum of five sample periods were utilized each week from May 6 to September 10, a period of about 18 weeks. Sampling was divided into four strata, which were analyzed separately to increase statistical significance of the results. Strata were defined as:

Weekend AM - 7:30am-3:00pm	Strata 1
Weekend PM-3:00pm-10:30pm	Strata 2
Weekday AM - 7:30am-3:00pm	Strata 3
Weekend PM - 3:00pm-10:30pm	Strata 4

Sample periods were 7.5 hours in duration. Holiday weekdays counted as weekends.

Information was recorded for angler data and biological data. All anglers returning during the sampling period were surveyed. A small number of shore anglers were missed, usually because they returned to the campsite on smaller side trails or simply drove away before the surveyor could question them. The survey was voluntary, but no refusals were encountered.

Angler data recorded included:

- Time angling trip was concluded.
- Boat or Shore angler(s).
- Repeat visitors (y/n).
- Number in party.

- Number of anglers in party.
- Number of fishing rods typically used at any one time.
- Where does the angler normally reside: Local (Peace River Area), Resident (B.C.), Non Resident (Canada but not BC) or Non-Canadian.
- How many hours did the angler(s) fish?
- What type of terminal gear was used: Bait (any gear with bait on it) Hardware or Fly.
- How many fish, by species, were killed or released and any marks on fish kept and released.

Biological information was collected on all harvested fish that were not cleaned, and many that were cleaned, but with heads intact. Others were not sampled because of time constraints during a busy period, or if the angler was in a hurry. A total of 119 fish were sampled out of a possible 125. All but 14 of the samples were rainbow trout.

Biological information recorded included:

- Species. The following abbreviations are in use throughout this report:

  RBT = Rainbow Trout

  KO = Kokanee

  WG = Whitefish (General)

  BT = Bull Trout

  LT = Lake Trout

- Weight (g)
- Length (mm)
- Capture Method (Bait, Hardware, or Fly)
- Age (Scale Sample)
- Ageing Method
- Date
- Marks
- Comments

Approximately 5010 catchable (Avg. 158.2 g) adipose fin clipped rainbow trout were released into Dinosaur Reservoir on July 27, 1999. Another 4640 catchable adipose fin clipped rainbow trout were released on July 12, 2000. These catchable size fish are a direct addition to the stock available for the recreational angler. The adipose clips allow an assessment of their contribution to the fishery and a rough estimation of fish populations in the catchable size classes.

Smaller fingerlings were released in July of 1999 (avg. 73 g) and 2000 (avg. 45 g). It was hoped the 1999 fingerlings would make up part of the angling catch in 2000, but none were encountered. These fish would belong to the year one age class that averaged 26.6 cm in length and made up just 3.4% of the landed samples in 2000.

Table 1. Stocking history during creel surveys.

Species	*Date Stocked*	*Number Stocked*	*Marking*	*Average Weight (g)*	*Type*
Rainbow Trout	2001-07-11	5006	Adipose	185.19	Catchables
Rainbow Trout	2000-07-12	4640	Adipose	204.09	Catchables
Rainbow Trout	2000-07-12	10010	Adipose	45.45	Fingerlings
Rainbow Trout	1999-07-27	5010	Adipose	174.85	Catchables
Rainbow Trout	1999-07-27	7522	Right Ventral	72.57	Fingerlings

RESULTS

Angler Data *(all confidence intervals are at 95% level)*

A total of 895 anglers in 304 parties were interviewed. From this it was estimated a total of 1761 (+/- 181) anglers utilized Dinosaur Lake during the summer creel survey period in 2000. These anglers expended an estimated 4339 (+/- 897) hours to catch an estimated 1236 (+/- 279) fish, 1086 (+/- 279) which were rainbow trout.

Average angler overall catch rate was 0.25 fish per hour, or 0.56 fish per day. The average angler day was 2.25 hours (+/- 0.20). The success rate varied considerably by month and whether the party was using boat (0.31 fish per hour) or shore (0.16 fish per hour). 70% of fish were released. The average shore angler party was comprised of 2.14 people while the average boat angler party was comprised of 2.28 people.

Table 2. Release rates by species.

Release Rate (%)					
RBT	*LT*	*BT*	*WG*	*KO*	*ALL*
69.9%	42.1%	94.7%	80.0%	100.0%	70.2%

Local fishermen accounted for most anglers (85.2%) utilizing Dinosaur Lake during the 2000 season (See Table 2). This is comparable with previous surveys.

Table 3. Visitor residency.

Visitor Residency				
	Local	*Res*	*Non-Res*	*Non-Can*
Season (n)	757	54	69	9
Season (%)	85.2%	6.1%	7.8%	1.0%

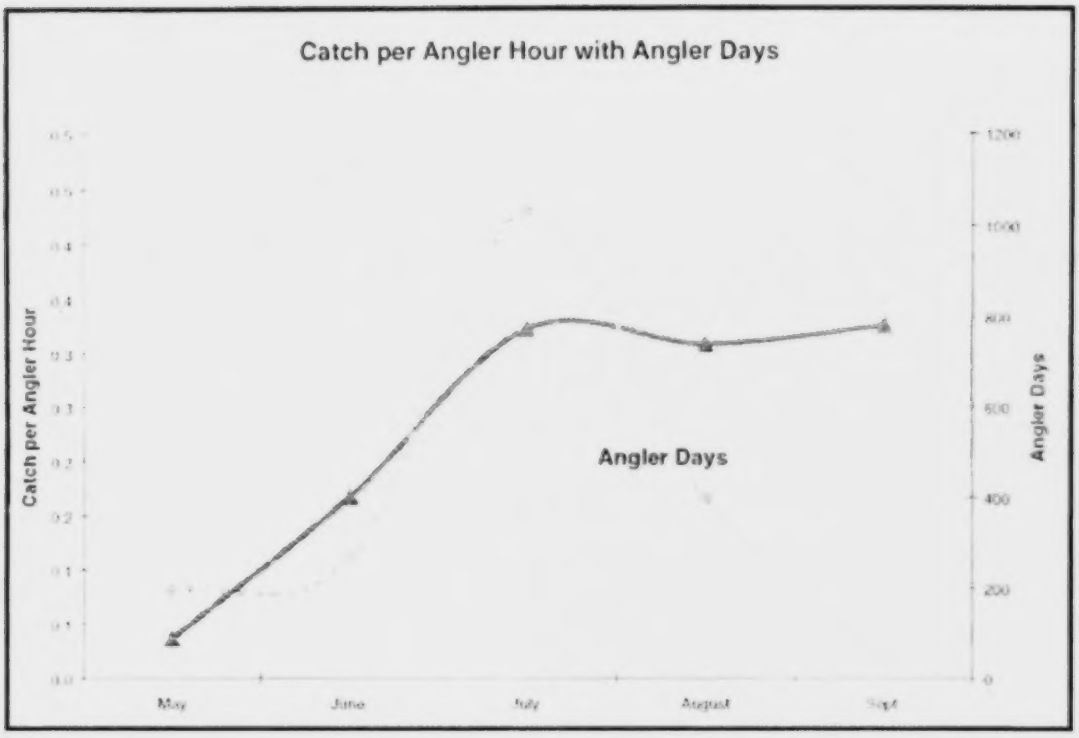

Figure 2. Catch per angler hour with angler days, by month.

Table 4. Angling capture methods.

Capture Methods		*n*	%
	Bait	119	39.1%
	Hardware	255	83.9%
	Fly	82	27.0%
	Combination	130	42.8%
	Total Parties	304	

Stocking Data

Fish that were stocked in the lake in 1999 and 2000 were marked with either adipose or ventral fin clips. This marking is an attempt to determine the contribution stocked fish make to the fishery and to help determine the overall population of fish in Dinosaur Lake. The fish stocked in 1999 and 2000 are the only marked fish in the lake, as previous stocked fish have not been marked since the on-site hatchery closed. Unmarked fish are wild stocks. In 1999 it was found that many anglers released fish in the size range of the released catchables, even if they were legal. In most cases there was an assumption that the size requirement for Dinosaur Reservoir was 30 cm like other lakes and streams in the area. Another common reason given by anglers was a desire for a 'sporting' experience. Smaller fish were often released in the hunt for larger fish.

In 2000 the catchables released in 1999 were of sufficient size to be landed. The catchables released in July 2000 were larger then the previous year, averaging 204 grams compared to 175 grams for fish released in 1999. The population estimate below will assume both groups were in the practical size range for fish landed by anglers.

To estimate the population of Rainbow Trout and the contribution of stocked fish in Dinosaur Lake, a Mark-Recapture calculation was used as follows:

$$N = nM/R$$

Where: N = Total RBT population
n = # RBT sampled
M = # of marked fish released
R = # of marked fish caught

9650 catchable size fish were released into Dinosaur Reservoir in 1999 and 2000. 37 of 105 RBT sampled were marked in 2000. The estimated total population is found to be 27,385 Rainbow Trout of catchable size.

A number of qualification must be made on this estimate. The mark-recapture estimate is only valid for a closed population. If fish are entering (through GMS and/or tributaries) or exiting (through Peace Canyon Dam), the calculation becomes less valid. An unknown number

of fish do move in and out of the system, and therefor it is not closed. In addition, it is unknown if behaviour or survival rates are different for released hatchery fish. They may distribute themselves differently in the reservoir, or may be more (or less) susceptible to predators, namely Lake Trout. It is also possible they escape into the Peace River at a different rate than wild fish. The fins of hatchery fish are visibly deteriorated and may effect swimming ability and efficiency. All of these factors may affect the result of the Mark-Recapture calculation and it should therefore be used as a rough estimate only.

Biological Data

Rainbow trout was the predominant sport fish captured by anglers on Dinosaur Lake (88%). Biological data was collected on 119 sport fish harvested during the survey period. This included 105 Rainbow Trout, 9 Lake Trout, 1 Whitefish, 1 Kokanee and 1 Bull Trout.. There were no confirmed or reported catches of Arctic Grayling, Lake Whitefish or Burbot.

An estimated 1236 fish were caught during the creel census period of 2000. Most of these (1086) were rainbow trout. There were no obvious signs of parasites or disease, both caught and sampled fish appeared healthy. Tables 4 to 6 and Figures 3 to 6 illustrate key findings.

Table 5. Number of fish samples taken.

	May	*June*	*July*	*Aug*	*September*	*Season*
Samples Taken	6	32	41	40	0	119
Species Distribution						
RBT	3	26	36	40	0	105
LT	3	3	3	0	0	9
BT	0	1	0	0	0	1
WG	0	1	2	0	0	3
KO	0	1	0	0	0	1

Table 6. Average lengths (mm) and weights (grams) of sampled fish.

Avg. Sample Length	*May*	*June*	*July*	*Aug*	*September*	*Season*
!RBT	345	333	295	298		307
LT	583	401	473			486
Avg. Sample Weight						
RBT	337	380	280	283		310
LT	2419	588	1125			1377

Table 7. Estimated total catch.

Estimated Total Catch (Killed + Released)						
	RBT	*LT*	*BT*	*WG*	*KO*	*TOTAL*
May	19	15	11	7	0	52
June	80	0	31	3	0	114
July	550	14	11	17	0	592
August	355	28	3	3	6	395
Sept.	38	0	0	0	3	40
Season	1086	56	56	29	9	1236
Confidence	(+/-) 279					

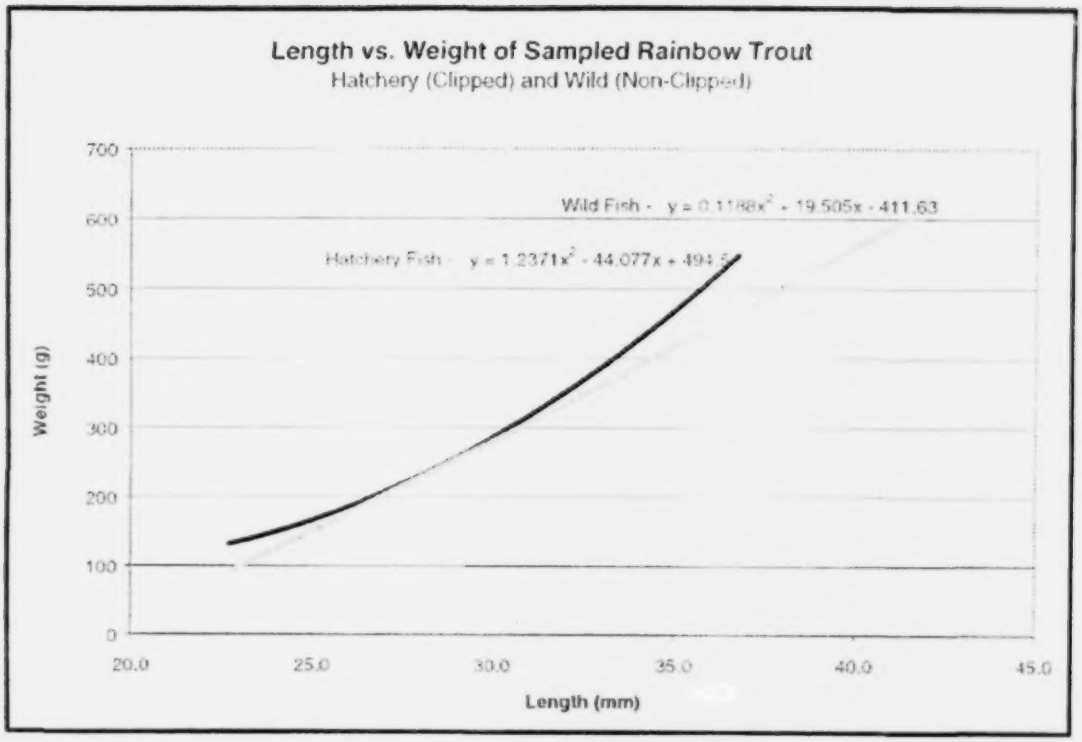

Figure 3. Length vs. weight of sampled Rainbow Trout.

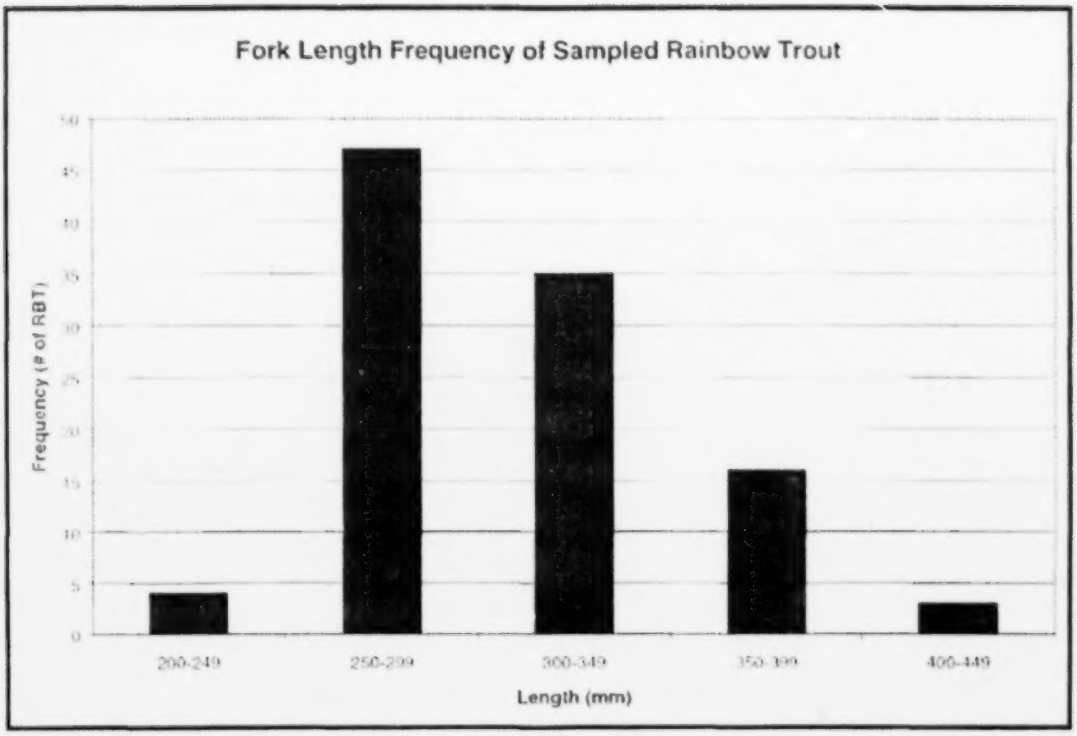

Figure 4. Fork length frequency of sampled Rainbow Trout.

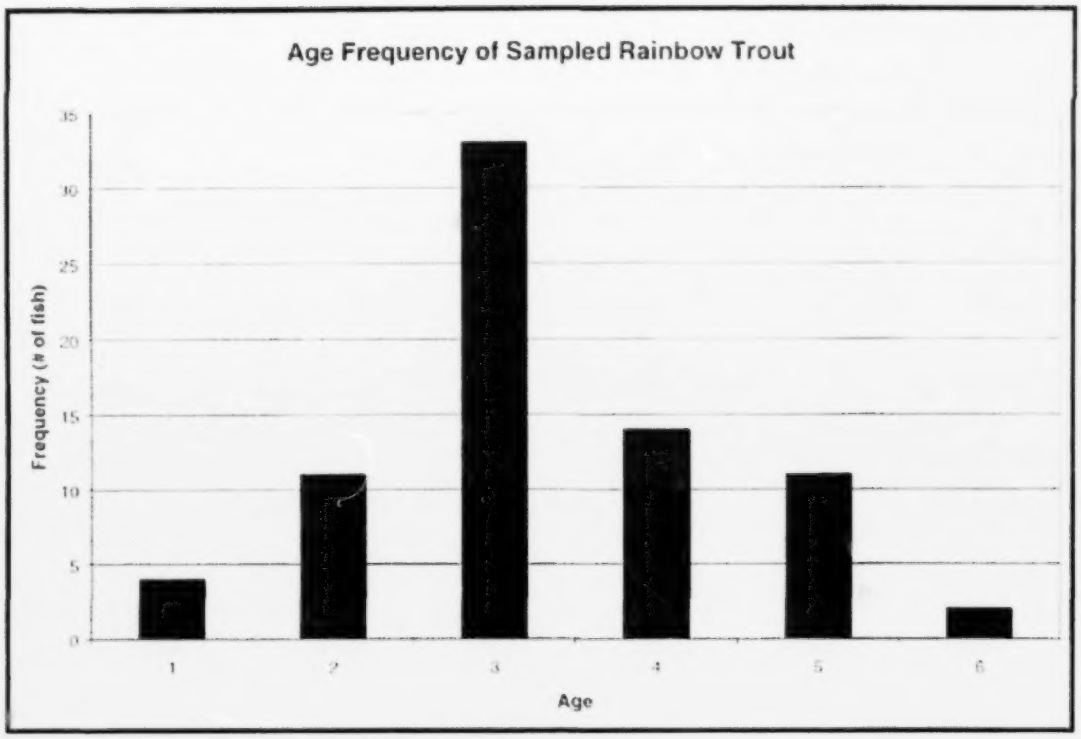

Figure 5. Age frequency of sampled Rainbow Trout.

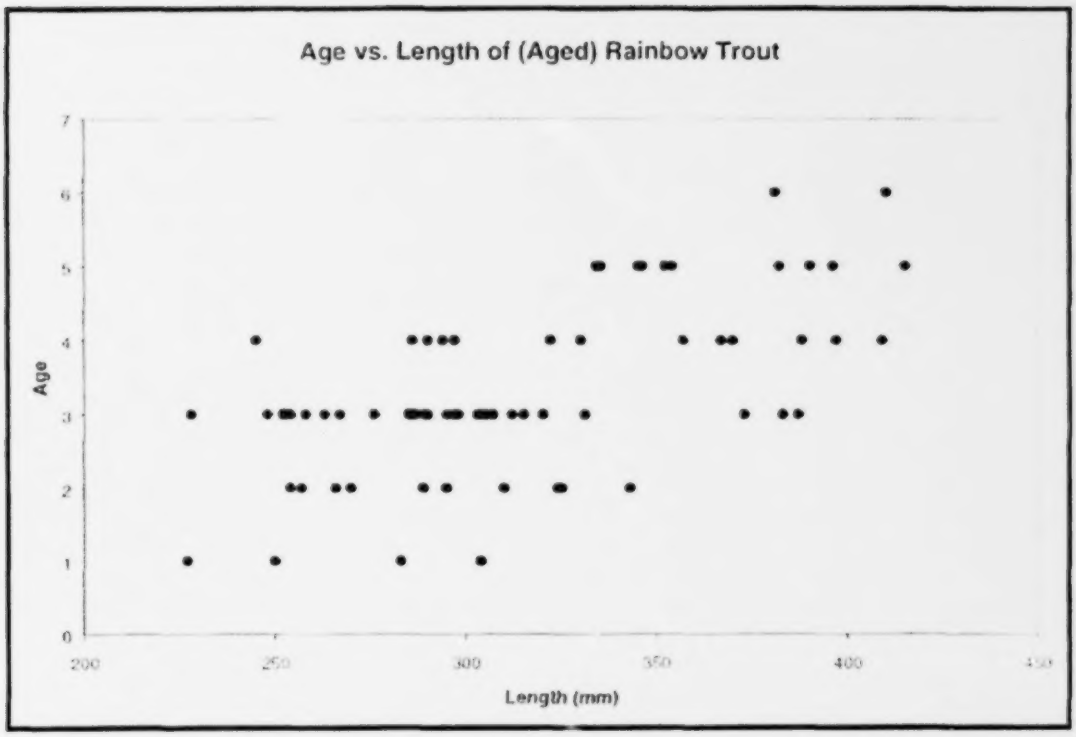

Figure *6.* Age vs. Fork Length of sampled Rainbow Trout

DISCUSSION

Comparisons with Previous Surveys

A summarization of key comparisons from Pattenden & Ash (1993b). Note that the survey periods for 1999 and 2000 were considerably longer than previous years.

Table 7. Angling data comparisons with previous Dinosaur Lake surveys (1984-2000).

Year	*Effort (Anglers)*	*Effort (Hours)*	*Catch*	*Harvest*	*Proportion Harvested*	*Catch Rate (Fish/hr)*	*Composition %Wild*	*%Hatchery*
1984	4702	13470	3965	3965	1.00	0.29	41.2	58.8
1985	1237	3940	1195	627	0.52	0.30	64.4	35.6
1986	2044	6397	2380	799	0.33	0.37	53.2	46.8
1987	1240	2932	597	274	0.45	0.20	48.6	51.4
1988	1599	3496	997	421	0.42	0.29	47.9	52.1
1999	1787	3772	1276	421	0.33	0.31	N/A	N/A
2000	1761	4339	1236	368	0.30	0.25	64.8	35.2

Observations

Angler satisfaction was not measured quantitatively, but there appeared to be a perception of below average angling opportunities and inconsistent success. The actual success rate of 0.25 fish per hour is rated as low by Pattenden & Ash (1993b), but may be comparable to other opportunities in the region (Blackman & Newshome, 1993). Many who experienced low or moderate success did not express surprise or disappointment. The reservoir has now been fished for almost twenty years, and the moderate success levels seem to be well known to local anglers (who make up 85.2% of angler visits). Use levels would likely respond quickly to increases or decreases in success rates. This potential effect of the stocking program should be realized.

Qualitative observation and discussion revealed a profile of the typical angler as a local visitor, in a boat, with low to average angling skill and experience, and concerned with overall experience (scenery, weather, socialization etc.) as much as angling success. These anglers often

were fishing as a secondary activity; the main reason for the visit was boating. The scenery and length of the reservoir make it ideal for boating and sightseeing.

The existence of a municipal campground adjacent to the boat launch allows continued popularity on weekends, mostly with local families (Ft. St. John, Dawson Creek, and Chetwynd). It also exposes a transient clientele of anglers who are generally stopping for one night on their way to/from Alaska.

Sixty percent of parties surveyed were using a boat to fish. The success rate varied considerably by month and whether the party was using boat (0.31 fish per hour) or shore (0.16 fish per hour). The difference in success is primarily due to the lack of good fish habitat that is accessible on foot. Many areas near the campground are shallow mud or rock flats. In addition, boat anglers may be more skilled and experienced.

Fundamental data on the fish of Dinosaur Reservoir is scarce. The limiting factor(s) on population are unknown. The reservoir appears to have limited primary production. Aquatic plant communities are almost non-existent and the erosion prone shoreline has little structure (trees, or rocks) to provide slope stability or protective fish habitat. This may be particularly poor for young fish. The cold water temperature and short summer season may also affect the availability of food.

A major limiting factor is likely the small amount of creek spawning habitat available to fish. Enhancement of existing channels and creation of new spawning habitat would be a long term solution that should reduce the dependence on the provincial hatchery stocking program. This problem is discussed in Pattenden and Ash, (1993a).

It is unknown how many fish leave and enter through the dams. Hammond (1986) monitored release and found fish moved from GMS Tailrace to lower Dinosaur Reservoir in a period of less than three weeks. This led to considerable concern over the rapid entrainment of fish through the Peace Canyon Dam (Hammond, 1986). Entrainment remains a major concern and may have a major impact on stocking in the reservoir.

Summary

Estimated catch rates for previous surveys remained relatively constant, ranging from a high of 0.37 fish/h in 1986 to a low of 0.20 fish/h in 1987. The 2000 overall catch rate of .25 fish/h falls well within this range, suggesting the success rate in the fishery has not changed considerably over the intermittent years. The contribution made from stocking is estimated at 35%. In the past it was estimated at 50% (Hammond, 1987). A much smaller number of fish have been stocked since the on site hatchery was closed. It is likely that regenerative capabilities of the wild population will not succeed in maintaining a strong fishery without habitat enhancement or a continued reliance on costly stocking effort. For a discussion of habitat enhancement options see Pattenden & Ash (1993a).

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APPENDIX B

2000 Data Summary (with 95% Confidence Intervals)

Note: Results cover sample period only (May 06 - Sept 10)

Total # Anglers by Strata

	1	2	3	4	Total
May	48	146	0	34	228 (+/-71)
June	46	133	25	66	270 (+/- 93)
July	77	229	50	455	811 (+/- 118)
August	43	144	100	127	413 (+/- 119)
Sept	0	33	0	5	38 (+/- 32)
Season	214	685	175	687	1761 (+/- 181)

Note: Season is not sum of monthly calculations.

Average Angler Day: 2.25 Hours (+/- 0.20)

Min: 0.1

Max: 8

Estimated Total # Angler Days
(Total Angler hours/Average Angler Day)

	1999	2000
May	165	194
June	287	265
July	740	1030
August	546	400
Sept.	90	40
Season	1828	1928

Estimated Total Angler Hours

SUM	May	June	July	Aug	Sept	Combined
1	68	91	193	82	0	433
2	300	281	593	305	84	1563
3	0	52	102	249	0	403
4	68	172	1431	264	5	1940
Month	436	596	2318	899	90	4339
1999 Monthly	340	593	1526	1126	186	3772

CI	May	June	July	Aug	Sept	Combined
1	60	74	91	41	0	126
2	87	128	176	110	57	247
3	0	63	45	105	0	155
4	40	116	400	99	60	369
Month	316	406	712	354	117	897
1999 Monthly	202	304	494	471	115	764

Average Anglers per Party

Boat	Shore
2.28	2.14

Boat/Shore Composition

	Boat	Shore	Total
# Parties	182	122	304
%	60%	40%	100%

Visitor Residency

	Local	Res	Non-Res	Non-Can
Season (n)	757	54	69	9
Season (%)	85.2%	6.1%	7.8%	1.0%

Average Catch per Angler Hour (all species)

	Boat	Shore	Combined	1999 Combined
May	0.061	0.000	0.036	0.146
June	0.106	0.220	0.167	0.180
July	0.369	0.243	0.322	0.237
August	0.439	0.090	0.308	0.605
Sept.	0.321	0.333	0.325	0.296
Season	0.306	0.163	0.249	0.309

Average Catch per Angler Day (all species)

	Boat	Shore	Combined	1999 Combined
May	0.137	0.000	0.079	0.301
June	0.239	0.496	0.376	0.372
July	0.829	0.547	0.725	0.489
August	0.988	0.203	0.693	1.249
Sept.	0.722	0.750	0.731	0.611
Season	0.689	0.365	0.558	0.638

Estimated Total Catch (# Fish)

May	52	
June	114	
July	592	
August	395	
Sept.	40	
Season	1236	+/- 278.7

Average Catch per Party

Killed	Released	Total
0.411	0.970	1.381

Release Rate (%)

RBT	LT	BT	WG	KO	ALL
69.9%	42.1%	94.7%	80.0%	100.0%	70.2%

Estimated Total Killed

	RBT	LT	BT	WG	KO	TOTAL
May	11.1	14.9	0.0	0.0	0.0	26
June	22.9	0.0	2.9	0.0	0.0	26
July	132.5	8.5	0.0	5.6	0.0	147
August	138.1	11.3	0.0	0.0	0.0	149
Sept.	10.0	0.0	0.0	0.0	0.0	10
Season	327	32	3	6	0	368
CI (+/-)	109					

Estimated Total Released

	RBT	LT	BT	WG	KO	TOTAL
May	7.4	0.0	11.1	7.4	0.0	26
June	57.1	0.0	28.6	2.9	0.0	89
July	417.1	5.6	11.3	11.3	0.0	445
August	217.0	16.9	2.8	2.8	5.6	245
Sept.	27.5	0.0	0.0	0.0	2.5	30
Season	759	24	53	24	9	868
CI (+/-)	171					

Estimated Total Catch (Killed + Released)

	RBT	LT	BT	WG	KO	TOTAL
May	19	15	11	7	0	52
June	80	0	31	3	0	114
July	550	14	11	17	0	592
August	355	28	3	3	6	395
Sept.	38	0	0	0	3	40
Season	1086	56	56	29	9	1236
CI (+/-)	279	Note: Small sample sizes and high variance for most species resulted in too much error for meaningful confidence intervals.				

Capture Methods

	n	%
Bait	119	39.1%
Hardware	255	83.9%
Fly	82	27.0%
Combination	130	42.8%
Total Parties	304	

	May	June	July	Aug	September	Total/Season
Samples Taken	6	32	41	40	0	119

Species Distribution of Samples

RBT	3	26	36	40	0	105
LT	3	3	3	0	0	9
BT	0	1	0	0	0	1
WG	0	1	2	0	0	3
KO	0	1	0	0	0	1

Avg. Sample Length (cm)

RBT	34.5	33.3	29.5	29.8	na	30.7
LT	58.3	40.1	47.3	na	na	48.6
WG	na	36.5	36.8	na	na	36.7

Avg. Sample Weight (g)

RBT	337	380	280	283	na	310
LT	2419	588	1125	na	na	1377
WG	na	527	567	na	na	554

Estimated Seasonal Biomass Removed (Total Killed Catch x Avg Weight)

	g	Kg
RBT	101252	101.25
LT	44570	44.57
WG	3260	3.26

Catch per Angler Hour by Number of Parties

Catch per Angler Hour	Angling Parties 2000	Angling Parties 1999
0.0-0.09	197	211
0.1-0.19	19	15
0.2-0.29	16	13
0.3-0.39	4	16
0.4-0.49	8	6
0.5-0.59	15	20
0.6-0.69	7	8
0.7-0.79	5	5
0.8-0.89	3	1
0.9-0.99	0	0
1.0-1.09	10	11
1.1-1.19	2	2
1.2-1.29	2	1
1.3-1.39	3	3
1.4-1.49	0	1
1.5-1.99	3	2
2.0-2.99	5	8
3.0-3.99	3	6
4.0-4.99	0	0
5+	0	1

Fork Length Frequency of Sampled Rainbow Trout

Fork Length	# of RBT
200-249	4
250-299	47
300-349	35
350-399	16
400-449	3